This listing of claims will replace all prior versions, and listings, of claims in this application:

LISTING OF CLAIMS:

1. (Original): A method for tracking ectopic beats through template matching, comprising the steps of:

(a) capturing a first ECG signal in a signal processing unit;

(b) permitting a user to mark a begin point and an end point of the captured first ECG signal;

(c) defining a reference template as being a waveform segment between the marked begin and end points of the first ECG signal;

(d) acquiring data at the signal processing unit; and

(e) using a correlation coefficient calculation on the acquired data to identify a best fit between the reference template and the acquired data.

2. (Original): The method of claim 1, wherein the acquired data is acquired across multiple leads at a given point in time and is provided either from a data storage device or from a real-time data stream.

3. (Original): The method of claim 2, including the additional step of aligning on a display an image of the reference template with a beat within the acquired data across the multiple leads so as to display the extent of the identified best fit of the reference template with

the acquired data from each of the multiple leads.

4. (Original): The method of claim 1, including the additional step of outputting a quantitative indicator of the correlation coefficient calculation.

5. (Original): The method of claim 4, wherein the data is acquired from multiple leads and wherein the quantitative indicator is a composite average of coefficients calculated from the multiple leads.

6. (Original): The method of claim 5, wherein the quantitative indicator is displayed as a graph showing percentage of fit.

7. (Original): The method of claim 1, wherein the reference template is a segment of a spontaneous beat and wherein the acquired data is a paced beat.

8. (Original): The method of claim 1, wherein the reference template is a segment of a first spontaneous beat and wherein the acquired data is a second spontaneous beat which is different than the first spontaneous beat.

9. (Original): The method of claim 1, wherein the acquired data is from a real-time data stream, the method including the additional step of repeating the correlation coefficient calculation on the acquired data at a prescribed interval.

10. (Original): A method for deriving a p-wave signal from a premature atrial contraction ("PAC") beat to assist a person in diagnosing a heart, comprising the steps of:

(a) selecting a QRS-T segment of a reference ECG signal;

(b) permitting a user to mark a begin point and an end point of the selected segment of the reference ECG signal;

(c) defining a reference template as being a waveform segment between the marked begin and end points of the selected segment of the reference ECG signal;

(d) acquiring the PAC beat at the signal processing unit from multiple leads; and

(e) processing the PAC beat so as to derive the p-wave signal.

11. (Original): The method of claim 10, wherein the processing step comprises subtracting the reference template from a predetermined segment of the PAC beat.

12. (Original): The method of claim 10, wherein the reference ECG signal is a single beat.

13. (Original): The method of claim 10, wherein the reference ECG signal is a signal derived from an average of multiple beats.

14. (Original): The method of claim 10, wherein the reference ECG signal is a beat

that immediately precedes the PAC beat.

15. (Original): The method of claim 10, including the additional step of synchronizing the reference template and the PAC beat by aligning respective waveform segments thereof.

16. (Original): The method of claim 15, wherein the alignment is by using a correlation coefficient calculation on the acquired data to identify a best fit between the respective waveform segments.

17. (Original): The method of claim 15, wherein the respective waveform segments are the QRS complexes of the reference template and the PAC beat.

18. (Original): The method of claim 17, wherein the alignment is by using a correlation coefficient calculation on the PAC beat to identify a best fit between the QRS complexes of the reference template and the PAC beat.

19. (Original): The method of claim 16, including the additional step of permitting the person to shift the alignment thereby causing a change in the correlation coefficient calculation

20. (Original): The method of claim 16, including the additional step of permitting the person to shift the reference template to a waveform segment between corresponding begin and end points of a different beat thereby causing a change in the correlation coefficient calculation

21. (Original): The method of claim 10, including the additional steps of:

repeating the acquiring and processing steps so as to derive p-waves from at least two different PAC beats, and

comparing the derived p-waves to one another.

22. (Original): The method of claim 21, wherein the comparing step comprises performing a cross correlation waveform analysis.

23. (Original): The method of claim 21, including the additional step of selectively indicating on an output device a quality of a match as a function of the comparing step to thereby provide an indicator as to whether the derived p-waves have the same focal origin.

24. (Original): The method of claim 10, including the additional steps of comparing the derived p-wave to a library of p-waves of known focal origin, and predicting the most likely site of the origin as a function of the comparison.

25. (Original): The method of claim 10, wherein the derived p-wave is a derived, spontaneous p-wave, the method including the additional steps of maneuvering a pace mapping catheter within or adjacent the atria while pacing the heart while repeating the acquiring and processing steps so as to derive a paced p-wave, and comparing the derived, paced p-wave to the derived, spontaneous p-wave.

26. (Original): The method of claim 10, including the additional step of determining an integral value of the area of the derived p-wave signal.

27. (Original): The method of claim 26, including the additional step of normalizing the integral value over a length of the derived p-wave signal.

28. (Original): The method of claim 27, wherein the marked beginning and end points define a QRS segment of the reference ECG signal, the method including the additional step of measuring the QRS residue of the derived p-wave signal to provide an indicator of the alignment quality between the QRS segment of the PAC beat and a QRS segment of the reference template.

29. (Original): The method of claim 28, wherein the processing step comprises subtracting the reference template from the QRS segment of the PAC beat, and wherein the QRS residue is an integral value computed after the processing step.

30. (Original): The method as in claim 10, wherein the acquiring and processing steps are repeated, the method including the additional steps of:

calculating, for each iteration of the acquiring and processing steps, the integral value of the QRS segment of the reference template and the integral value of the PAC beat,

determining any change in absolute peak value percentage of the integral values between the reference template and the PAC beat,

whereby any baseline drift is identified.

31. (Original): A method for deriving a non-synchronous subcomponent from a first heartbeat signal having a composite waveform which includes a synchronous subcomponent overlapping the non-synchronous subcomponent in order to assist a person in diagnosing a heart, comprising the steps of:

(a) selecting a synchronous subcomponent of a second heartbeat signal which corresponds to the synchronous subcomponent of the first heartbeat signal;

(b) permitting a user to mark a begin point and an end point of the selected synchronous subcomponent;

(c) defining a reference template as being a waveform segment between the marked begin and end points of the selected synchronous subcomponent;

(d) acquiring the composite waveform of the first heartbeat signal at the signal processing unit from multiple leads; and

(e) processing the composite waveform beat so as to derive the non-synchronous subcomponent.

32. (Original): The method of claim 31, wherein the processing step comprises subtracting the reference template from a predetermined segment of the composite waveform.

33. (Original): The method of claim 31, wherein the selected synchronous subcomponent is from a single beat.

34. (Original): The method of claim 31, wherein the selected synchronous subcomponent is a signal derived from an average of multiple beats.

35. (Original): The method of claim 31, wherein the selected synchronous subcomponent is from a beat that immediately precedes the composite waveform.

36. (Original): The method of claim 31, including the additional step of synchronizing the reference template and the composite waveform by aligning respective synchronous waveform segments thereof.

37. (Original): The method of claim 36, wherein the alignment is by using a correlation coefficient calculation on the acquired data to identify a best fit between the respective synchronous waveform segments.

38. (Currently amended):The method of claim 36, wherein the respective waveform segments are the ~~s~~synchronous subcomponents of the reference template and the composite waveform.

39. (Original):The method of claim 38, wherein the alignment is by using a correlation coefficient calculation on the composite waveform to identify a best fit between the synchronous subcomponents of the reference template and the composite waveform.

40. (Original): The method of claim 37, including the additional step of permitting the person to shift the alignment thereby causing a change in the correlation coefficient calculation.

41. (Original): The method of claim 37, including the additional step of permitting the person to shift the reference template to a waveform segment between corresponding begin and end points of a different heartbeat thereby causing a change in the correlation coefficient calculation.

42. (Original): The method of claim 31, including the additional steps of:

repeating the acquiring and processing steps so as to derive non-synchronous subcomponents from at least two different composite waveforms, and

comparing the derived non-synchronous subcomponents to one another.

43. (Original): The method of claim 42, wherein the comparing step comprises performing a cross correlation waveform analysis.

44. (Original): The method of claim 42, including the additional step of selectively indicating on an output device a quality of a match as a function of the comparing step to thereby provide an indicator as to whether the derived non-synchronous subcomponents have the same focal origin.

45. (Original): The method of claim 31, including the additional steps of comparing the derived non-synchronous subcomponent to a library of non-synchronous subcomponents of known focal origin, and predicting the most likely site of the origin as a function of the comparison.

46. (Original): The method of claim 31, wherein the derived non-synchronous subcomponent is a derived, spontaneous non-synchronous subcomponent, the method including the additional steps of maneuvering a pace mapping catheter within or adjacent the atria while pacing the heart, and repeating the acquiring and processing steps so as to derive a paced non-synchronous subcomponent until such time that the derived paced and spontaneous subcomponents correlate with one another within a prescribed criterion.

47. (Original): The method of claim 31, including the additional step of determining an integral value of the area of the derived non-synchronous subcomponent.

48. (Original): The method of claim 47, including the additional step of normalizing the integral value over a length of the derived non-synchronous subcomponent.

49. (Original): The method of claim 31, including the additional steps of

comparing the derived non-synchronous subcomponent to a library of non-synchronous subcomponents of known focal origin, the derived non-synchronous subcomponent being a spontaneous non-synchronous subcomponent;

predicting the most likely site of the origin as a function of the comparison;

maneuvering a pace mapping catheter within or adjacent the heart while pacing the heart in real-time;

repeating the acquiring and processing steps so as to derive a paced non-synchronous subcomponent until such time that the derived, paced and spontaneous subcomponents correlate with one another within a prescribed criterion.

50. (New) The method of claim 25 wherein the derived, spontaneous p-wave defines a template and the comparing step comprises using a correlation coefficient to identify a best fit between the derived, spontaneous p-wave template and the derived, paced p-wave.

51. (New): A method for determining a most likely site of origin of a spontaneous P-wave comprising:

(a) defining a spontaneous P-wave as a template;

(b) maneuvering a pace mapping catheter within or adjacent the atria;

(c) pacing at a location in or adjacent the atria using a pace-mapping catheter;

(d) acquiring a paced P-wave signal from the pace-mapping catheter;

(e) comparing the spontaneous P-wave template to the paced P-wave signal; and

(f) repeating steps (b), (c), (d), and (e) until such time that the spontaneous P-wave template and the paced P-wave signal correlate with one another within a prescribed criterion.

52. (New) The method according to claims 51 wherein the paced P-wave signal is superimposed on an electrocardiac signal, the method further comprising the steps of:

(a) selecting a QRS-T segment of a reference ECG signal;

(b) permitting a user to mark a begin point and an end point of the selected segment of the reference ECG signal;

(c) defining a reference template as being a waveform between the marked begin and end points of the selected segment of the reference ECG signal;

(d) subtracting the reference template from the electrocardiac signal having the superimposed paced P-wave signal to define a resultant derived, paced P-wave signal; and

(e) comparing the resultant derived, paced P-wave signal to the spontaneous P-wave template.

53. (New) The method of claim 51 wherein the spontaneous P-wave is a spontaneous, derived P-wave.

54. (New) The method of claim 1 wherein the ECG signal is captured by a lead.

55. (New) The method of claim 54 wherein the lead is an intracardiac lead.

56. (New) The method of claim 10 wherein the ECG signal is captured by a

lead.

57. The method of claim 56 wherein the lead is an intracardiac lead.

REMARKS

Claims 38 has been amended to correct typographical errors.

New claims 50 - 57 have been added to more completely cover the disclosed subject matter.

Support for new claims 50 - 53 may be found in the specification at page 6, line 21 through page 7, line 3; page 11, lines 5-6; page 11, lines 20-21; page 13, line 14 through page 14, line 6; page 19, lines 4-5 and 15-17; and in original claims 10 and 25.

Support for new claims 54 - 57 may be found in the specification at page 15, lines 9-11; page 16, lines 12-13 and 16-19; and page 19, lines 17-20.

A prompt action on the merits is requested.

Respectfully submitted,

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David Leason
Reg. No. 36,195
Attorney for Applicants

DARBY & DARBY, P.C.
Post Office Box 5257
New York, NY 10150-5257
Phone (212) 527-7700